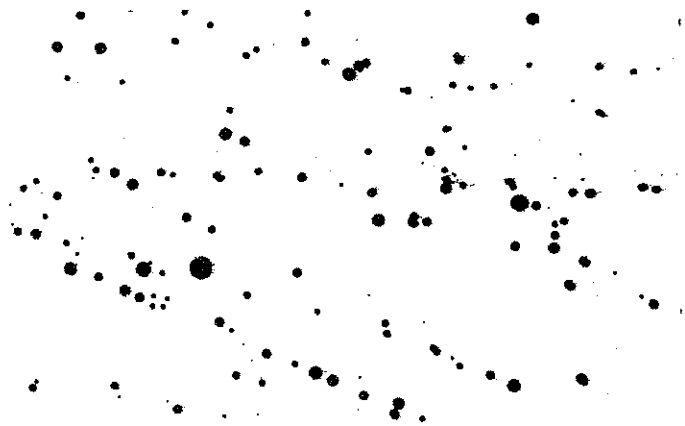
ARIZONA STATE DEPARTMENT OF HEALTH

ENVIRONMENTAL HEALTH SERVICES
DIVISION OF AIR POLLUTION CONTROL
4019 North 33rd Avenue
Phoenix, Arizona 85017

PARTICULATE MONITORING NETWORK DATA

- 1969 -



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September 1, 1970

PARTICULATES MONITORING NETWORK DATA
1969

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PARTICULATES MONITORING NETWORK DATA
1969

INTRODUCTION

A network of high-volume samplers was installed in 1969 to evaluate the magnitude of particulate matter pollution in Arizona atmospheres. The high-volume sampler was chosen to monitor particulates in the air because air quality criteria for particulate matter published by the U.S. Public Health Service were based on high-volume sampler measurements.[1] U.S. Public Health Service criteria constitute the main basis for State standards on ambient air quality.

The high-volume sampler measures the mass concentration of suspended particulates by capturing the particles on an 8 x 10 inch, pre-weighed, fiberglass filter. Photographs of the sampler are in the **Appendix** of this report.

Sampling time and flow rate were 24 hours and 1.1 - 1.7 cubic meters/min. The mass concentration was then computed by measuring the weight of collected particles and dividing it by the volume of air sampled.

The filters were analyzed for specific constituents such as benzene-soluble organics, sulfates, and various metals.

The sampling sites were classified into two source-related areas:

1. **Smelter areas -**	Ajo	Claypool (Miami)
	Douglas	East Plantsite
	Florence	Hayden
	San Manuel	Superior
2. **Background areas (no major sources) -**		Davis Dam
		Organ Pipe Cactus National Monument
		Page

These sampling locations are illustrated on **Figure 1.** Specific location details are listed in the **Appendix.** Davis Dam will be reclassified into a third area, power plants, in late 1970 or 1971, whenever the Mohave plant starts up. Page will be reclassified into this third area in 1973 or 1974 whenever the Navajo plant begins production. Thus the effects of the power plants on particulate concentrations will be easier to ascertain than the effects of the smelters.

Organ Pipe was chosen as a site to determine the background concentration of particulates in the Arizona desert.

FINDINGS

1. **Total Suspended Particulates -**

A summary of results is given in **Table I** and **Figure 2.** Six stations, Ajo, Claypool, Douglas, Florence, Hayden and Superior, exceeded both the annual and the daily standard. Douglas and Hayden were by far the highest. In fact, **Figure 2** indicates that both Douglas and Hayden exceeded the maximum daily standard, 100 ugm/m^3, 96% of the time in 1969. Ajo, slightly slightly exceeded the annual standard, 70 ugm/m^3, in 1969.

Five stations, Davis Dam, East Plantsite, Organ Pipe, Page and San Manuel, did not exceed the annual standard. The lowest three stations, Organ Pipe, Page and San Manuel were below the maximum daily standard, 100 ugm/m^3, 98% of the time.

The Maricopa County Health Department has a sampler on their building at 1825 East Roosevelt Street in Phoenix. They found the geometric mean for total particulates at that location to be 118 ugm/m^3 in 1969.

2. **Benzene Soluble (Table 2) -**

The highest annual average, 10.4 ugm/m^3, was in Douglas. This may have been a result of the sampler's proximity to heavy vehicular traffic at the International border.

Maricopa County reported 11.1 ugm/m^3, at their Phoenix location.

The highest annual averages in the National Air Sampling Network (NASN) in 1969 were 17.1 in Mobile, Alabama and 16.0 in Pasadena, California. [2]

There are no criteria or standards for benzene-soluble particulates.

3. **Sulfates (Table 2) -**

The highest station by far was Hayden. Other smelter areas were also significantly high. One interesting fact was the relatively low concentration of total suspended particulates in Organ Pipe, contrasted with the relatively high sulfates. This indicates that some particulates from Ajo may be getting to Organ Pipe.

Maricopa County reported an annual average of 3.36 ugm/m^3, from their Phoenix location on East Roosevelt Street.

The highest annual averages in the NASN in 1965 were 28.8 in New York City and 24.3 in Philadelphia.

4. **Metals (Table 2) -**

The metals with highest concentrations were Cadmium, Copper, Iron, Lead and Zinc.

4.1 **Cadmium** - In Hayden the annual average Cadmium concentration was the highest, 0.321 ugm/m^3. The maximum 24 hour average concentration was 2.786 ugm/m^3 in Hayden.

As a matter of interest, it was noted that Hayden's annual average, 0.321 ugm/m^3, was six times higher than the highest value in the 1964 NASN (National Air Sampling Network), 0.050 ugm/m^3 in Covington, Kentucky.

Table I

1969

TOTAL SUSPENDED PARTICULATES

Micrograms per Cubic Meter

STATION	NUMBER SAMPLES	MINIMUM	MAXIMUM	ARITH. MEAN	GEOM. MEAN	STD. GEOM. DEV.
Ajo	21	28	222	128	87	1.7
Claypool	48	38	344	131	117	1.6
Davis Dam	45	5	144	39	29	2.1
Douglas	26	54	703	357	240	1.7
East Plantsite	46	10	131	57	51	1.7
Florence	33	28	385	166	149	2.0
Hayden	37	87	716	245	224	1.6
Organ Pipe Cactus National Monument	13	14	51	28	26	1.5
Page	50	2	124	30	17	2.2
San Manuel	18	21	74	46	43	1.5
Superior	38	59	332	159	139	1.5

State Air Quality Standards -

24 hour average - limit of 100 micrograms per cubic meter

Annual geom. mean - limit of 70 micrograms per cubic meter

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Table 2

1969

SPECIFIC CONSTITUENTS OF PARTICULATE MATTER

Arithmetic Mean in Micrograms per Cubic Meter

	AJO	CLAYPOOL	DAVIS DAM	DOUGLAS	E. PLANTSITE	FLORENCE	HAYDEN	ORGAN PIPE	PAGE	SAN MANUEL	SUPERIOR
Benzene Sol.	2.9	5.5	1.4	10.4	2.0	3.6	5.6	1.0	1.4	1.6	3.2
Nitrates	.9	.8	1.2	.7	2.6	1.7	1.0	.5	.5	.4	.6
Sulfates	8.1	13.0	3.4	9.4	10.1	12.9	40.7	6.1	.2	6.2	7.8
Arsenic	.003	.01	.001	.004	.007	.01	.006	.005	.001	.009	.01
Cadmium	.005	.02	.002	.011	.006	.013	.321	.002	.002	.002	.019
Chromium	.006	.007	.004	.01	.006	.018	.013	.026	.004	.005	.009
Cobalt	.001	.004	.004	.001	.001	.009	.012	-	.003	.001	.002
Copper	.4	1.3	.4	.8	.5	.2	5.2	.5	.1	.7	.8
Iron	1.0	1.6	.6	2.5	1.1	1.7	4.8	.5	.4	1.0	1.2
Lead	.1	1.2	.1	.5	2.2	.5	3.2	.1	.04	.2	.5
Manganese	.03	.05	.02	.2	.02	.05	.05	.01	.01	.02	.1
Moly.	NR	.001	.003	.02	.0003	.008	.002	NR	.007	-	-
Nickel	.004	.004	.005	.008	.002	.05	.015	.012	.002	.003	.004
Zinc	1.8	2.8	2.7	2.8	7.9	3.9	3.4	.4	2.3	.2	1.7

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Division of Air Pollution Control

September 1970

4.2 Copper - Copper was highest in the smelter areas, with Hayden having the highest concentration. Even in Organ Pipe, Copper is present in the atmosphere in significant amounts. The 1969 annual average concentration in Hayden, 5.21 ugm/m^3, was eight times higher than the highest value in the 1964 NASN, 0.65 ugm/m^3, in Evansville, Indiana.

4.3 Iron - Again, Hayden had the highest annual average, 4.8 ugm/m^3, with other smelter areas three to four times lower. The highest arithmetic mean concentration in the 1964 NASN was 5.5 ugm/m3 in East Chicago, Indiana.

The maximum 24 hour average in Hayden was 10.2. The air quality criteria for iron oxide recommended by the American Industrial Hygiene Association in 1968 are: [3]

	24-hour Maximum – ugm/m3	– 30-day Maximum
Rural	100	
Residential	150	
Commercial	200	
Industrial.	250	 100

4.4 Lead - The highest annual averages were 3.2 in Hayden and 2.2 in East Plantsite. The highest average concentration in the 1964 NASN was 2.7 ugm/m3 in Minneapolis.

Maricopa County reported 2.82 ugm/m3 at 1825 East Roosevelt in Phoenix.

4.5 Zinc - The highest annual average concentration was 7.9 ugm/m3 at East Plantsite. The maximum annual average reported by NASN in 1964 was 1.70 at Covington, Kentucky.

5. Seasonal Effects -

Seasonal effects on particulate concentrations are shown on Figures 3. A. and 3. B. which plot monthly average concentrations in 1969.

CONCLUSIONS

The air quality standards for total suspended particulates were exceeded significantly in 1969, in Claypool, Douglas, Florence, Hayden and Superior.

In Ajo these standards were exceeded slightly.

In East Plantsite, Davis Dam and Page, the daily standard was exceeded but not the annual.

In Organ Pipe Cactus National Monument neither standard was exceeded.

Background particulate concentrations at two desert locations were determined. They are:

	Annual geometric mean - ugm/m3
Davis Dam	29
Organ Pipe	27

Five metals, Cadmium, Copper, Iron, Lead and Zinc, were present in high concentrations relative to the results of the National Air Surveillance Network.

The metals, especially Copper and Iron and sulfate concentrations are useful in determining the source of the particulates.

No strong seasonal effects on particulate concentrations were observed. There was a slight effect in Douglas where concentrations in November and December were two or three times higher.

REFERENCES

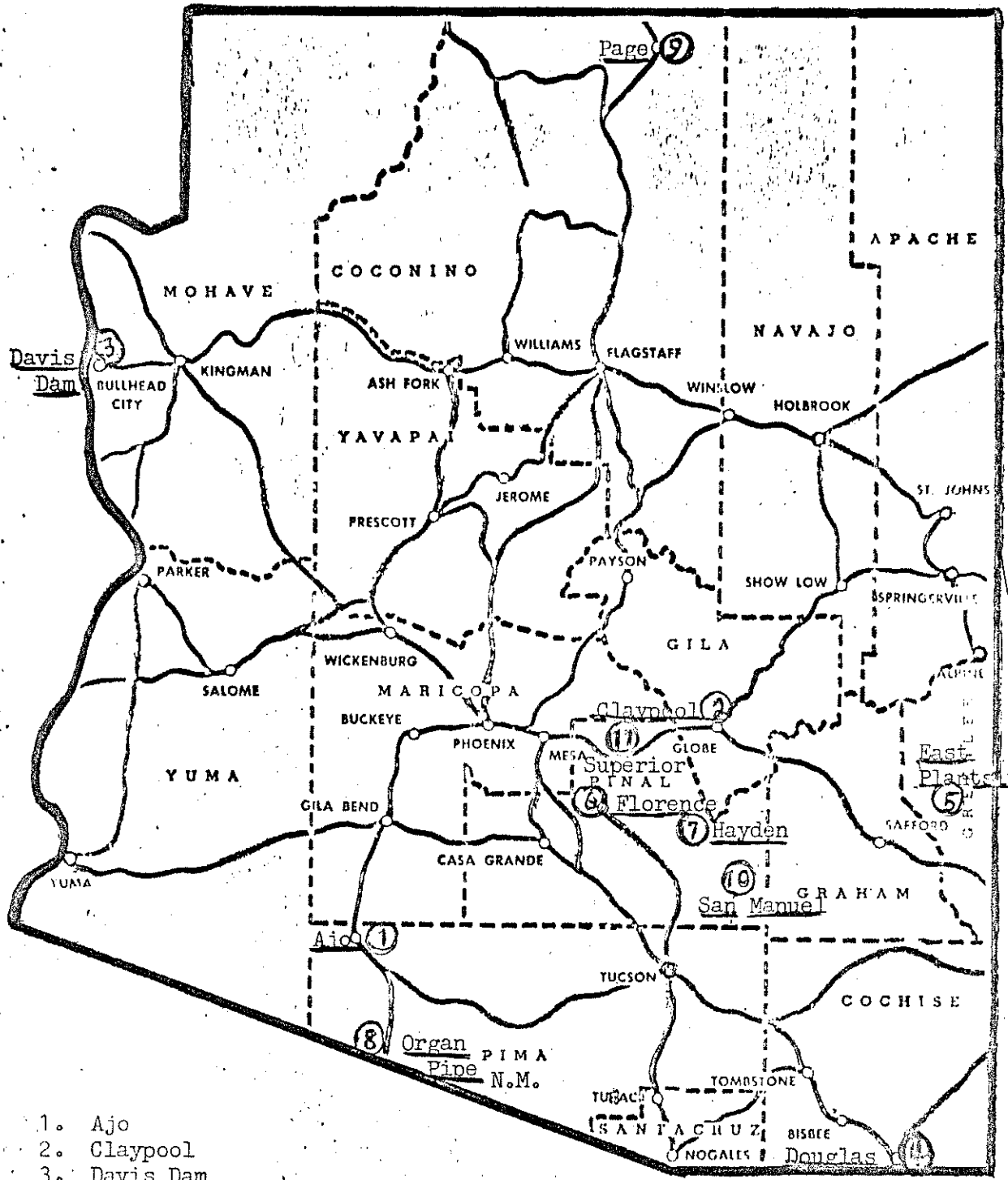
1 U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, Air Pollution Control Administration Publication Number AP-49, *Air Quality Criteria for Particulate Matter*, Washington, D.C., January 1969.

2 U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, Air Pollution Control Administration Publication Number APTD 68/9, *Air Quality Data*, Washington, D.C., 1966.

3 "Community Air Quality Guides", in *Journal of American Industrial Hygiene Association*, Volume 29, Number 1, 1968.

Figure 1

1969 HIGH VOLUME SAMPLER NETWORK



1. Ajo
2. Claypool
3. Davis Dam
4. Douglas
5. East Plantsite
6. Florence
7. Hayden
8. Organ Pipe
9. Page
10. San Manuel
11. Superior

ARIZONA STATE DEPARTMENT OF HEALTH
DIVISION OF AIR POLLUTION CONTROL
SEPTEMBER 1, 1970

Figure 2

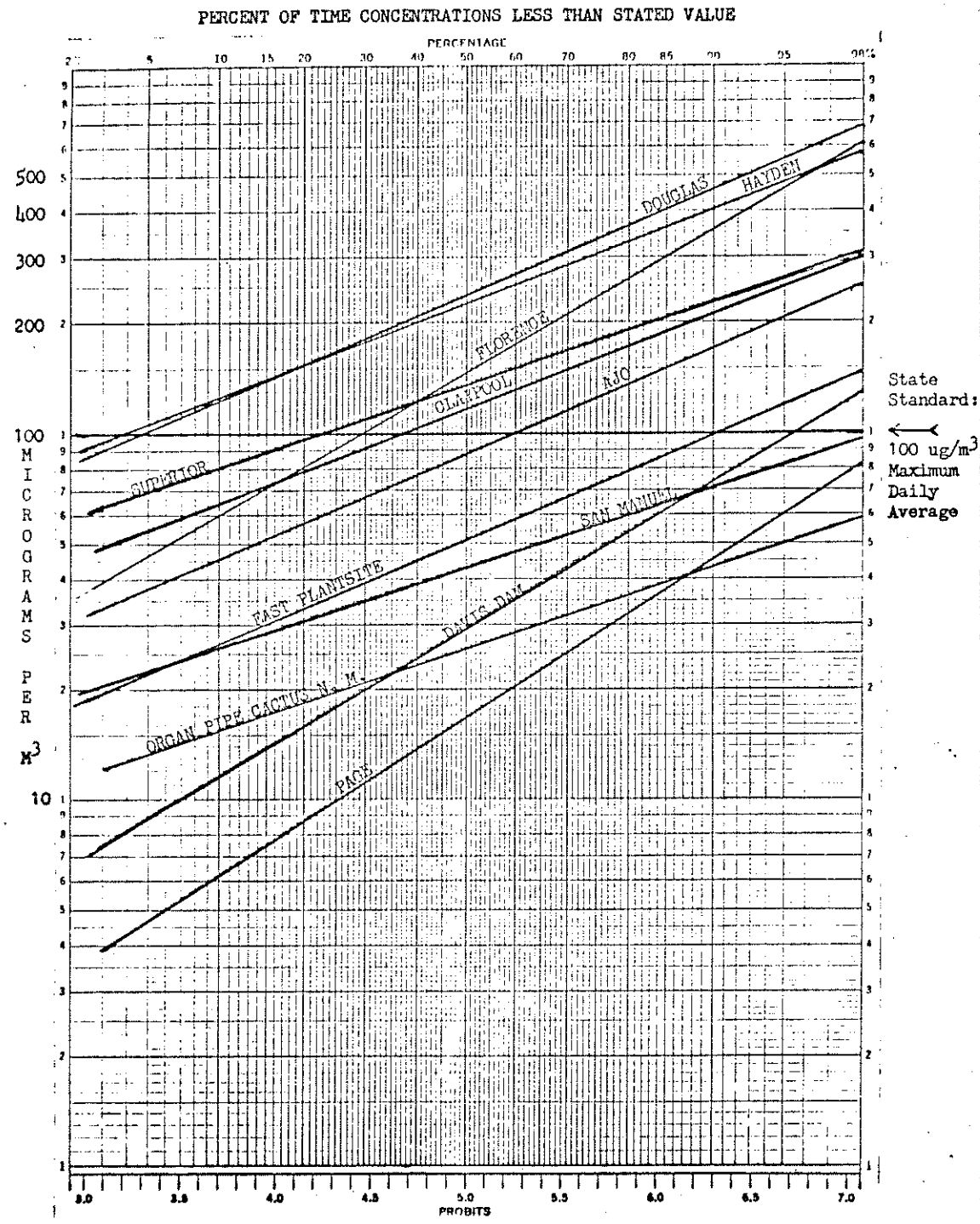

PERCENT OF TIME CONCENTRATIONS LESS THAN STATED VALUE
PERCENTAGE
2 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
500
400
300
200
100
MICROGRAMS PER M3
10
DOUGLAS
HAYDEN
FLORENCE
CLAYPOOL
NJC
SUPERIOR
SAN MANUEL
EAST PLANTSITE
DAVIS DAM
ORGAN PIPE CACTUS N. M.
PAGE
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS
State Standard:
100 ug/m3 Maximum Daily Average

Figure 5A

1969

TOTAL SUSPENDED PARTICULATES

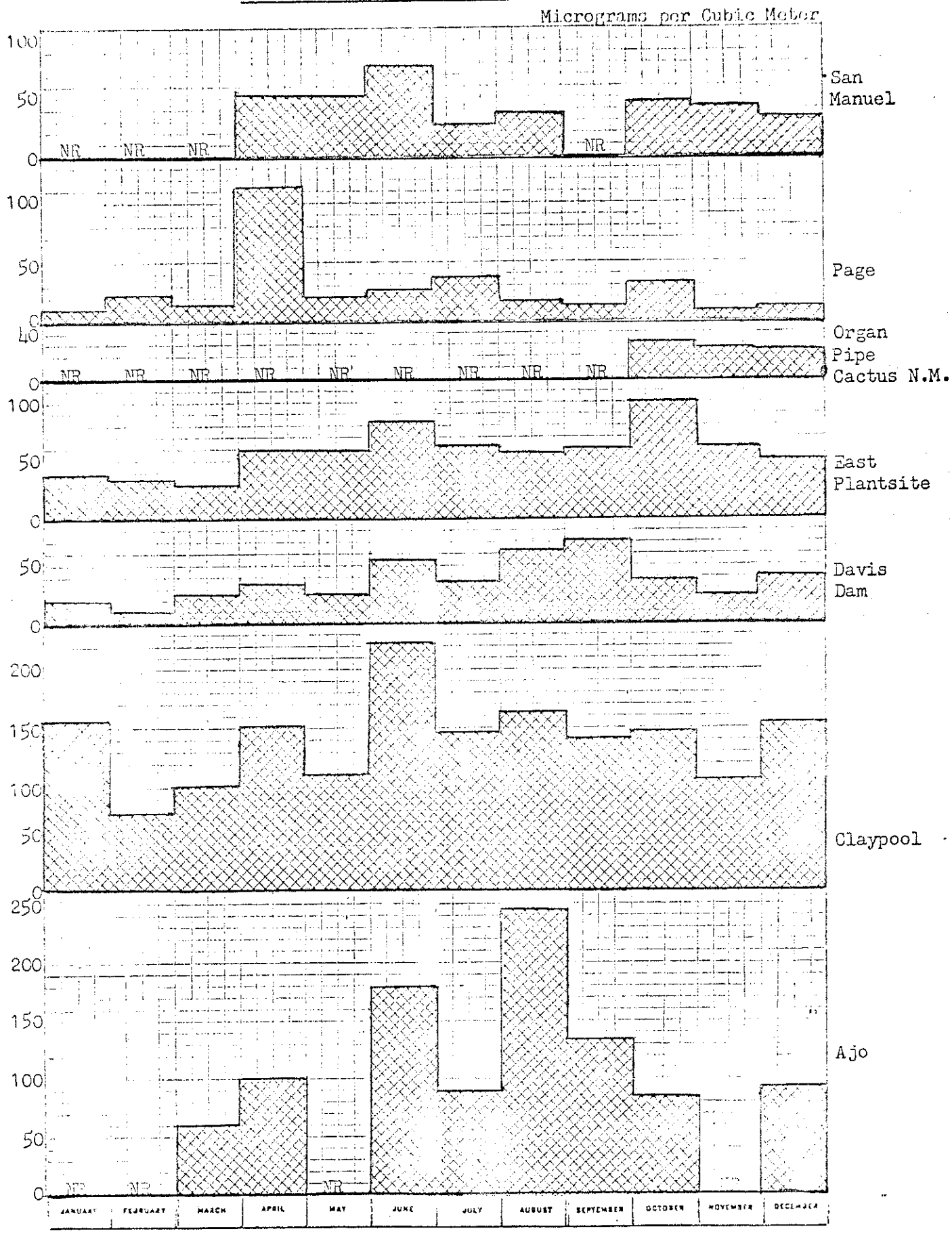


Figure 3B
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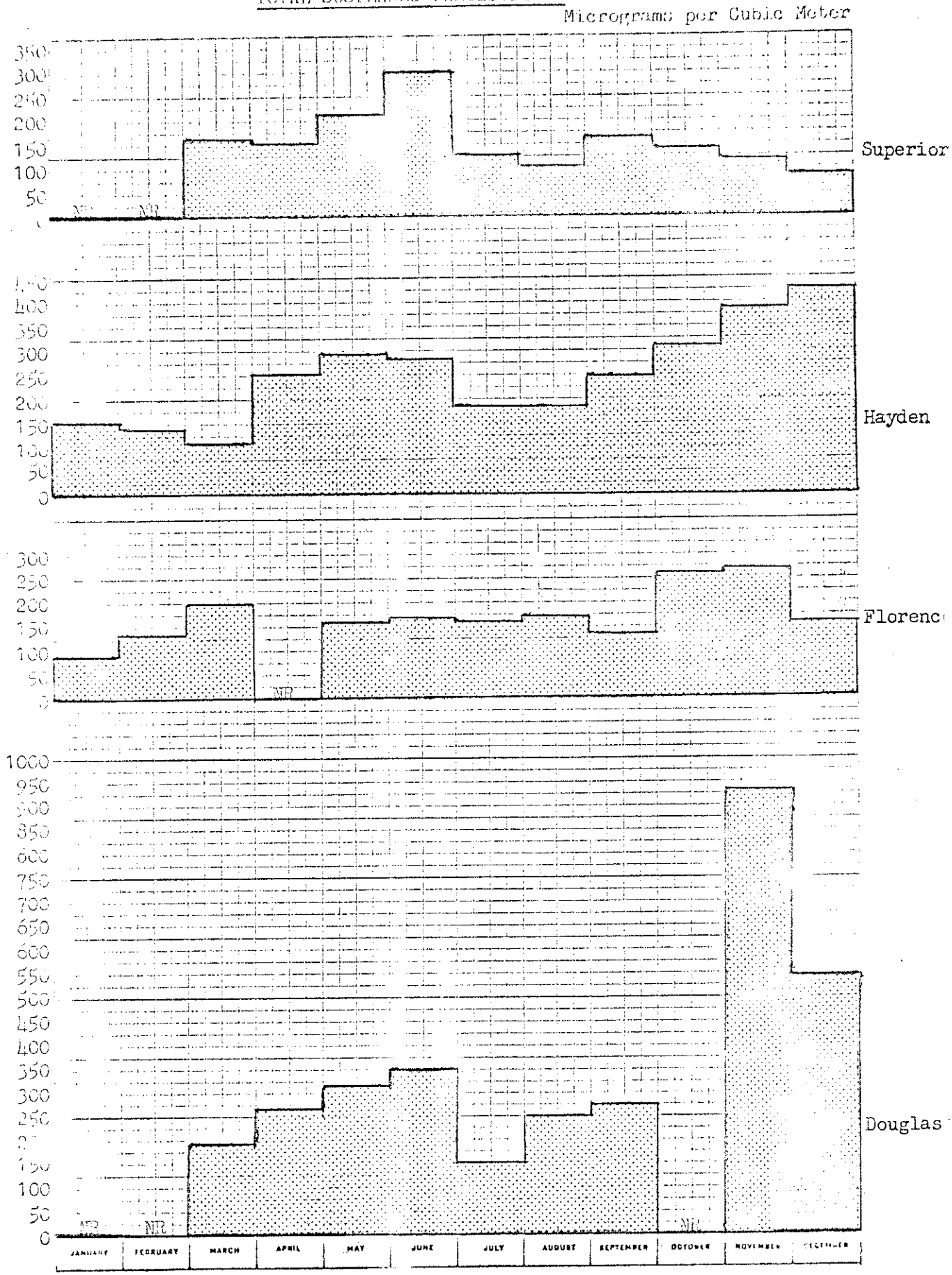
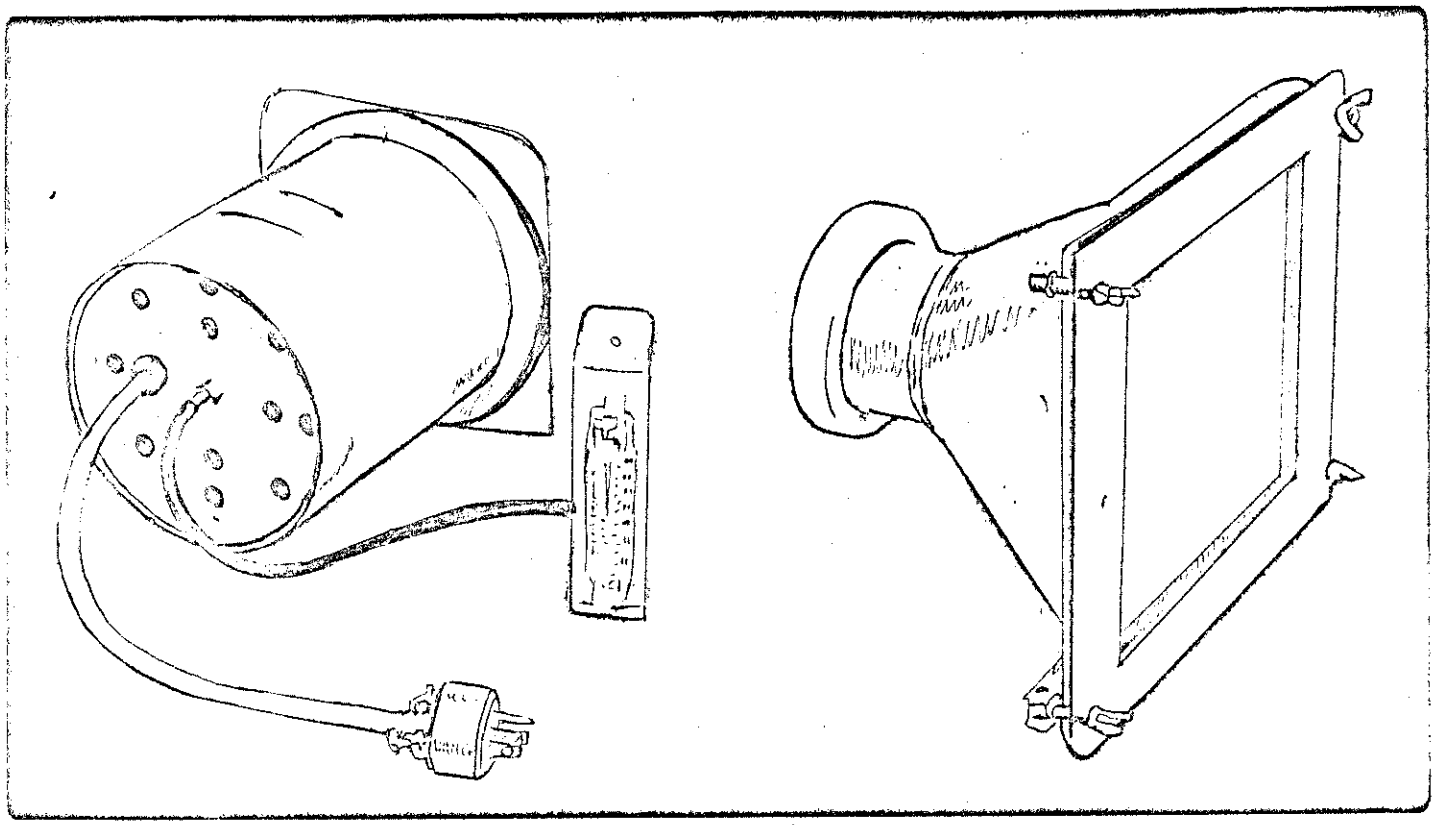
TOTAL SUSPENDED PARTICULATES



A P P E N D I X

MODEL GMWL 2000
Air Sampler With Filter Holder



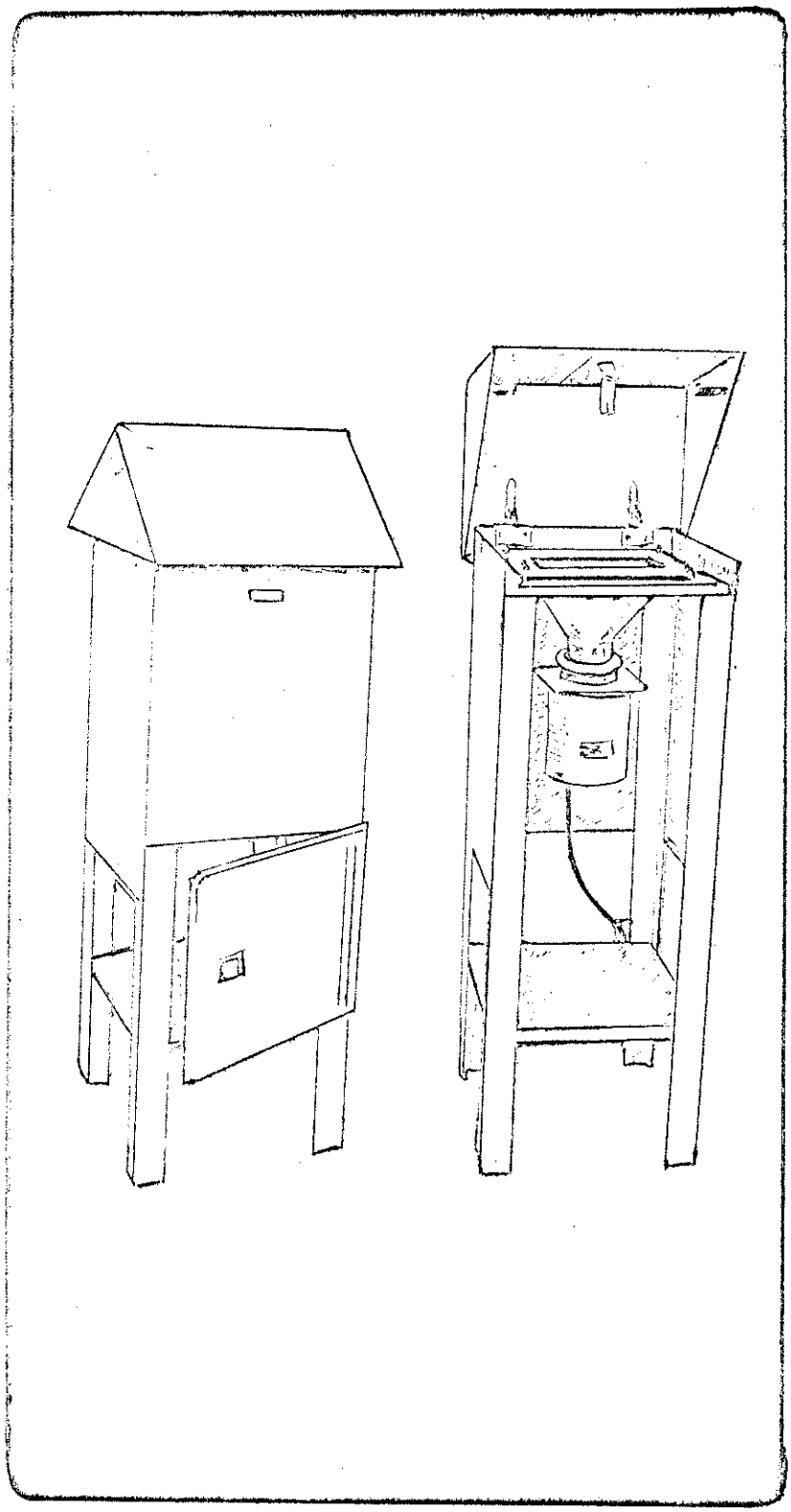
THIS unit is the recommended instrument for sampling large volumes of air, for suspended particulate matter. The Sampler consists of a specially housed motor in a cast aluminum housing.

The Filter Holder consists of a cone shaped stainless steel filter-support screen, which accommodates 8" x 10" filter paper, with a cast aluminum face plate, sealed with a neoprene sponge rubber gasket. Attached to Sampler with an aluminum threaded ring for easy assembly.

Air is drawn through the Filter Holder and measured with a visa float flowmeter which must be calibrated. Note: European models usually operate with 230 volt motors, available upon request.

SPECIFICATIONS: Net Weight: 14 lbs.
Gross Weight: 22 lbs.

MODEL GMWL 2000
With Aluminum Shelter



ALUMINUM shelter designed for outdoor sampling, all equipment contained inside shelter. Designed to keep everything out of the weather. All assembled ready for immediate operation. Fabricated from .080 aluminum, sturdy and rigid. Will not deteriorate and will last for many years. Roof of shelter hinges easily to insert or remove Filter Paper. No painting or maintenance necessary.

SPECIFICATIONS

Shelter Net Weight: 26 lbs.

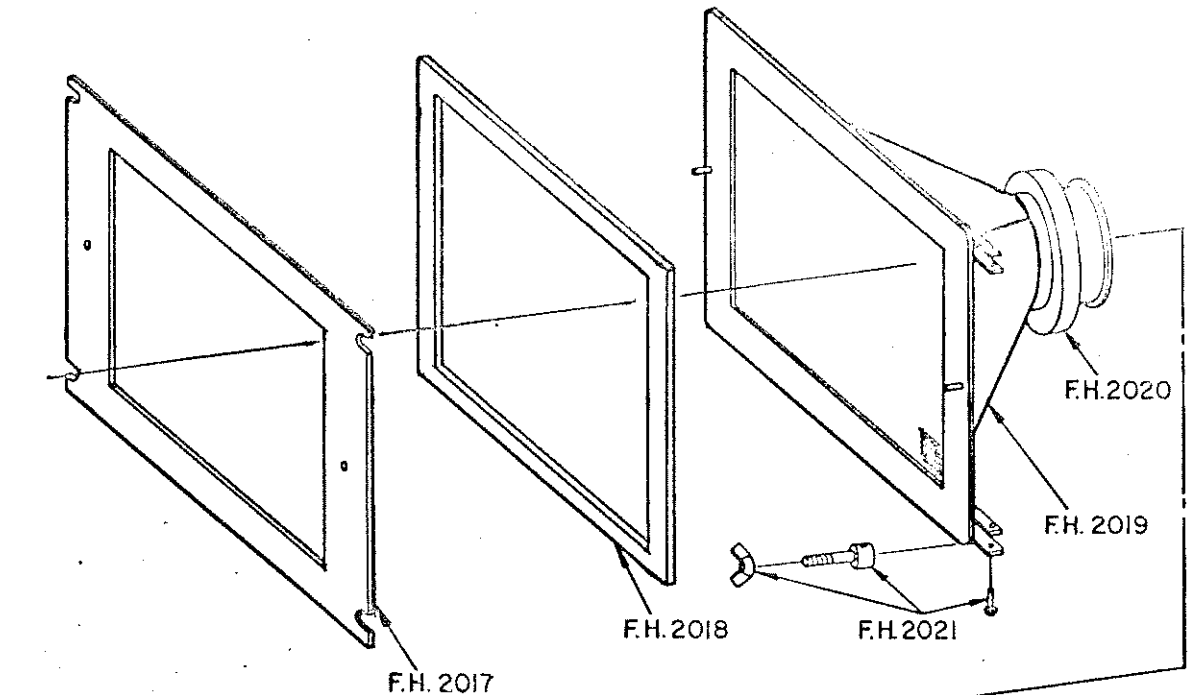
Complete Sampler, Filter Holder and Shelter Gross Weight: 48 lbs.

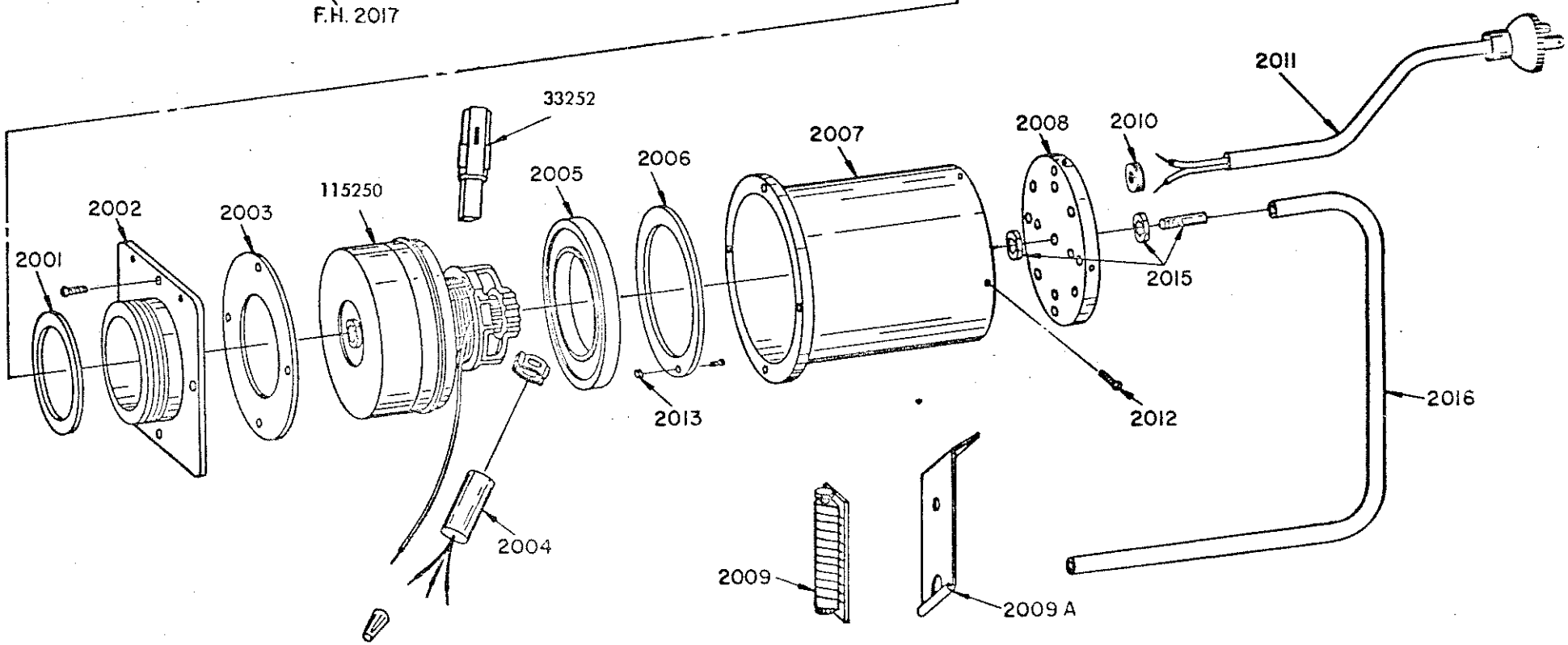
MODEL GMWL 2000

GENERAL METAL WORKS, INC.

8368 BRIDGETOWN RD

CLEVES, OHIO





HI-VOL SAMPLER LOCATIONS - 1969

1. **Ajo** – March 19 - April 15, 1969 - - - 600 North Second Avenue
   June 23 - - December 31, 1969 - Arizona Highway Dept., Well Road
2. **Claypool** – Arizona Highway Dept., U.S. Highway 60 - 70
3. **Davis Dam** – Davis Dam on the Colorado River, U.S. Bureau of Reclamation, Department of Interior
4. **Douglas** – U.S. Customs Building, First Street and R.R. Avenue
5. **East Plantsite** – Indian Road, across from the Longfellow Elementary School
6. **Florence** – Arizona State Prison, East Butte Avenue
7. **Hayden** – Hayden Fire Station, 643 Canyon Drive
8. **Organ Pipe Cactus National Monument** – National Park Service Visitors Center
9. **Page** – Airport, U.S. Bureau of Reclamation
10. **San Manuel** – First Avenue Elementary School, North First Avenue
11. **Superior** – Arizona Highway Department, 951 Main Street

ARIZONA STATE DEPARTMENT OF HEALTH

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SULFUR DIOXIDE

MONITORING NETWORK STUDY

- 1969 -

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EDMUND C. GARTHE, ASSISTANT COMMISSIONER
Environmental Health Services

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Sulfur Dioxide Monitoring Network Study 1969

During the year 1969, the Air Quality Evaluation Unit of the Abatement Section conducted statewide studies of sulfur dioxide (SO_2) contaminants in the air.

METHODS

Beckman Instruments Model 906 Sulfur Dioxide Analyzers and Bristol Model 760 Dynamaster Strip Chart Recorders were placed at designated sites throughout the State. The 906 Analyzers use the coulometric method for the detection of sulfur dioxide.

Analyzers and recorders were located within Cochise, Gila, Greenlee, Pima and Pinal Counties because of their relevance to populated areas and their availability. Studies of these counties in 1967 indicated that 99.9 percent of the sulfur dioxide emissions emanated from these areas. Too, measurements of sulfation rates in 1968 and 1969 showed high sulfation rates especially in the copper smelter towns and other industrial sites which are responsible for 99.8 percent of the total sulfur dioxide contaminants in Arizona's air.

Figure A (page 2), illustrates sulfur dioxide network locations. It should be noted that these locations are not to be interpreted as sites of concentrations of sulfur dioxide.

FINDINGS

Table I (page 3), presents a summary of the 1969 sulfur dioxide readings by maximum hourly, daily and annual averages. It shows the percent of time that the daily and hourly averages exceeded hourly and daily standards for sulfur dioxide in the ambient air as established by the State Board of Health in January 1970.

Figure B (page 4), shows the monthly average sulfur dioxide (SO_2) concentrations throughout the areas studied.

Figure C (page 5), indicates the percent of hourly averages which exceed the hourly Arizona State air quality standard for sulfur dioxide.

CONCLUSIONS

1. The sulfur dioxide levels in all seven smelter areas show high rates of sulfur dioxide in the ambient air and these levels substantially exceed the standards established by the State Board of Health.

2. Hayden evidenced the highest level of sulfur dioxide in the ambient air with the daily standard exceeded by a maximum factor of 15.4 ~~17.2~~ hourly by ~~5.8~~ 5.6 and annually by a factor of ~~9.8~~ 7.5.

3. Hayden also claims first place as the area in which the hourly standard was most frequently exceeded - a total of 615 times during 60 percent of the year 1969.

4. Douglas and Hayden, where SO_2 concentrations were highest from August to December, evidenced the most marked seasonal effects.

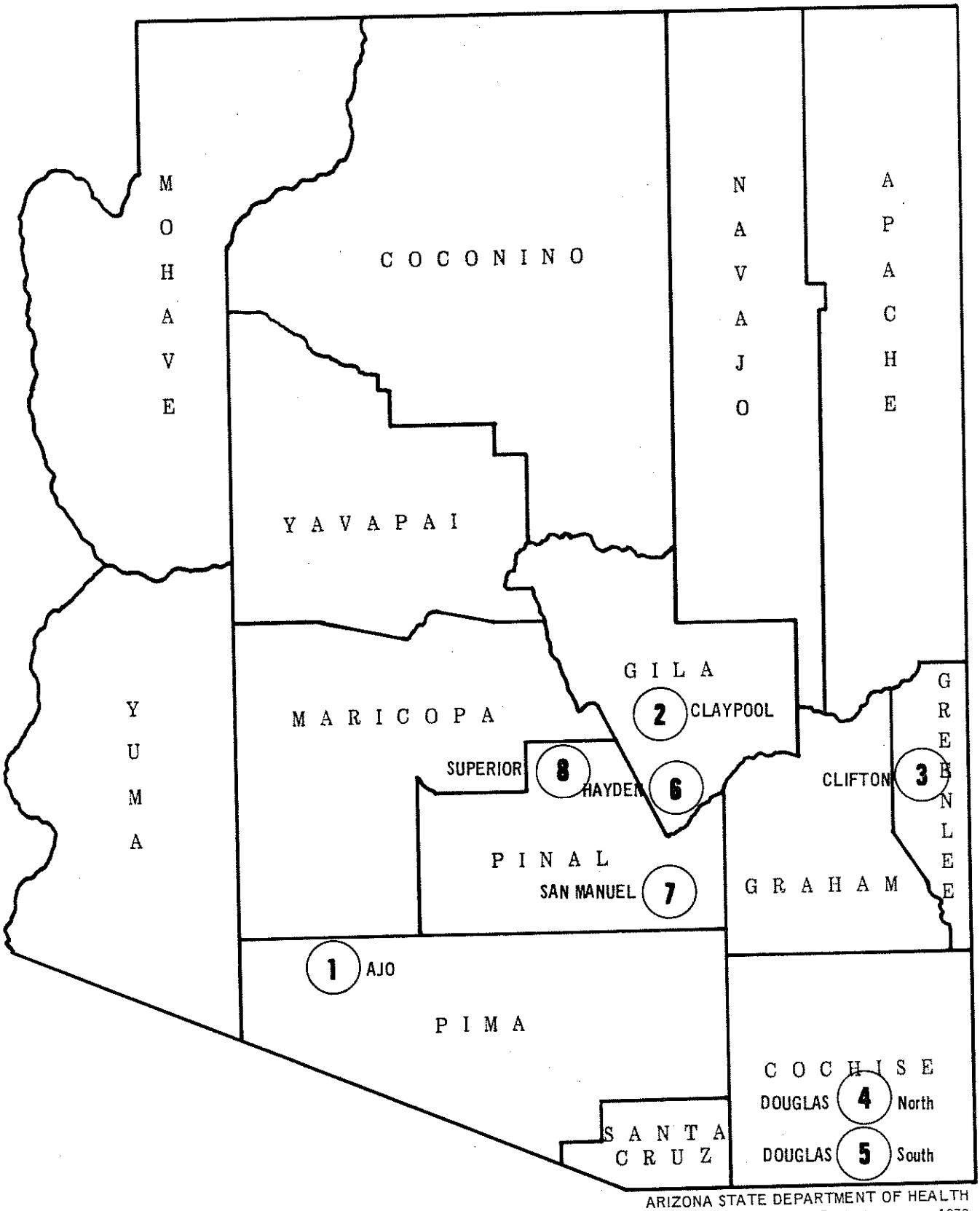
REFERENCE

U.S. Department of Health, Education, and Welfare; Public Health Service; Consumer Protection and Environmental Health Service, *Report for Consultation on the Phoenix-Tucson Intrastate Air Quality Control Region (Arizona),* September 1969.

ARIZONA

FIGURE A

1969 SULFUR DIOXIDE MONITORING NETWORK



ARIZONA STATE DEPARTMENT OF HEALTH
Division of Air Pollution Control - 1970

SUMMARY OF SULFUR DIOXIDE MONITORING - 1969

SO_2 Concentrations in Micrograms SO_2 per Cubic Meter of Air (ugm/m^3)

	AJO	CLAYPOOL	CLIFTON	DOUGLAS		HAYDEN	SAN MANUEL	SUPERIOR
				North	South			
Monitoring Period	3/19-4/21 7/7-12/31	2/7-12/31	10/1-12/31	11/13-12/31	4/2-12/31	1/17-12/31	5/22-12/31	4/11-7/30
Percent Data Recovery	77	80	84	51	63 ~~77~~	60	77	67
Maximum Hourly Average	3,928	4,910	2,455	4,664	3862 ~~4,296~~	4752 ~~4,910~~	4,910	4,419
Percent of Hours > 850 ugm/m^3 (State Hourly Standard)	1.5	2.9	0.9	2.0	3.6	12.5	1.4	0.7
Maximum Daily Average	1,105	565	417	908	515 ~~859~~	3849 ~~4,296~~	908	884
Percent of Days > 250 ugm/m^3 (State Daily Standard)	5.0	18.2	4.0	8.0	38.8	53.7	17.2	6.8
Annual Average	98	147	90	109	64 ~~270~~	377 ~~491~~	147	65

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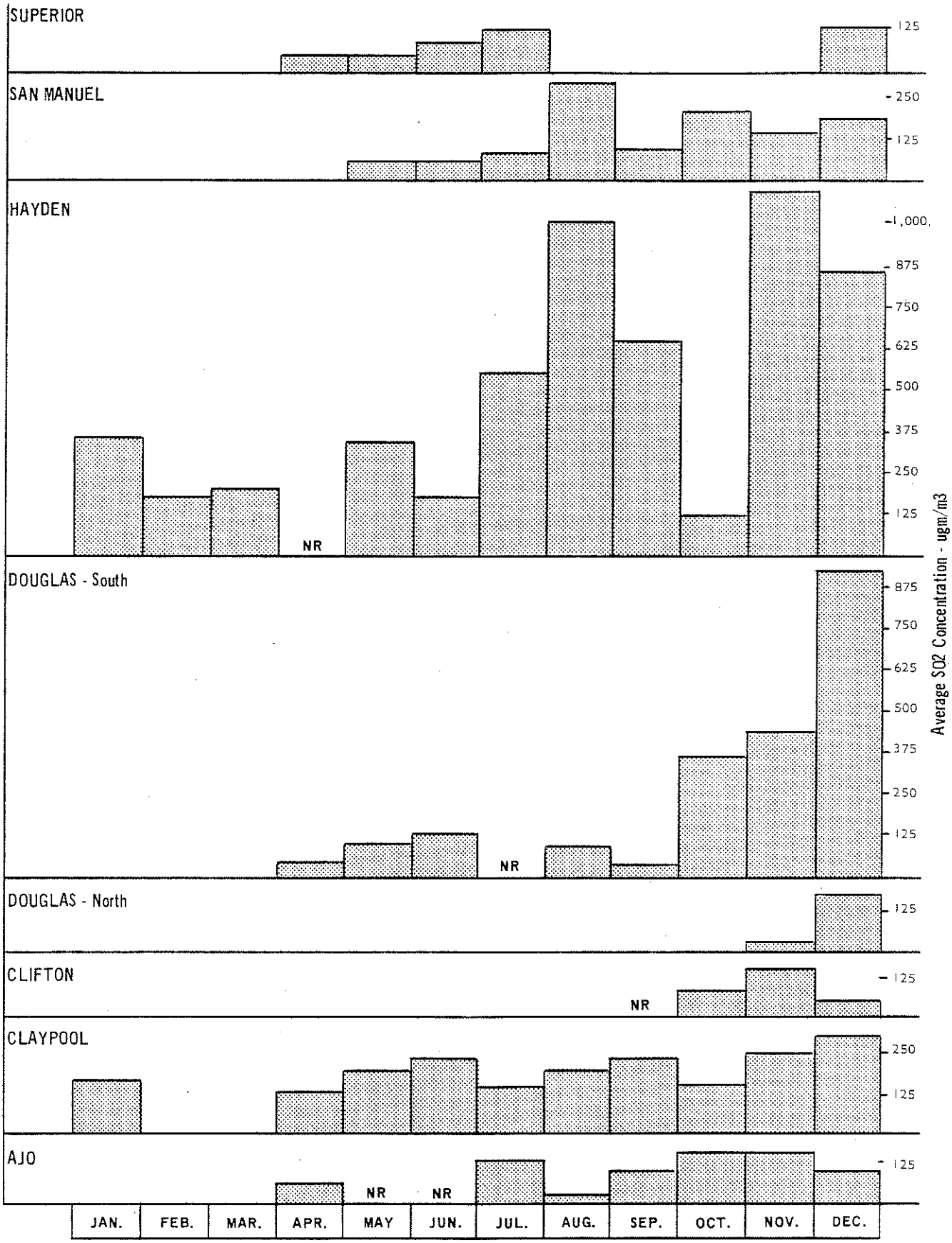
State Annual Standard is 50.

NOTE: 2,860 ugm/m^3 of SO_2 - 1 ppm (vol. at 0° C., 1 atm.)

TABLE 1

MONTHLY AVERAGE SULFUR DIOXIDE (SO_2) CONCENTRATIONS - 1969

FIGURE B



NR - Not Recorded (Analyzer malfunction)

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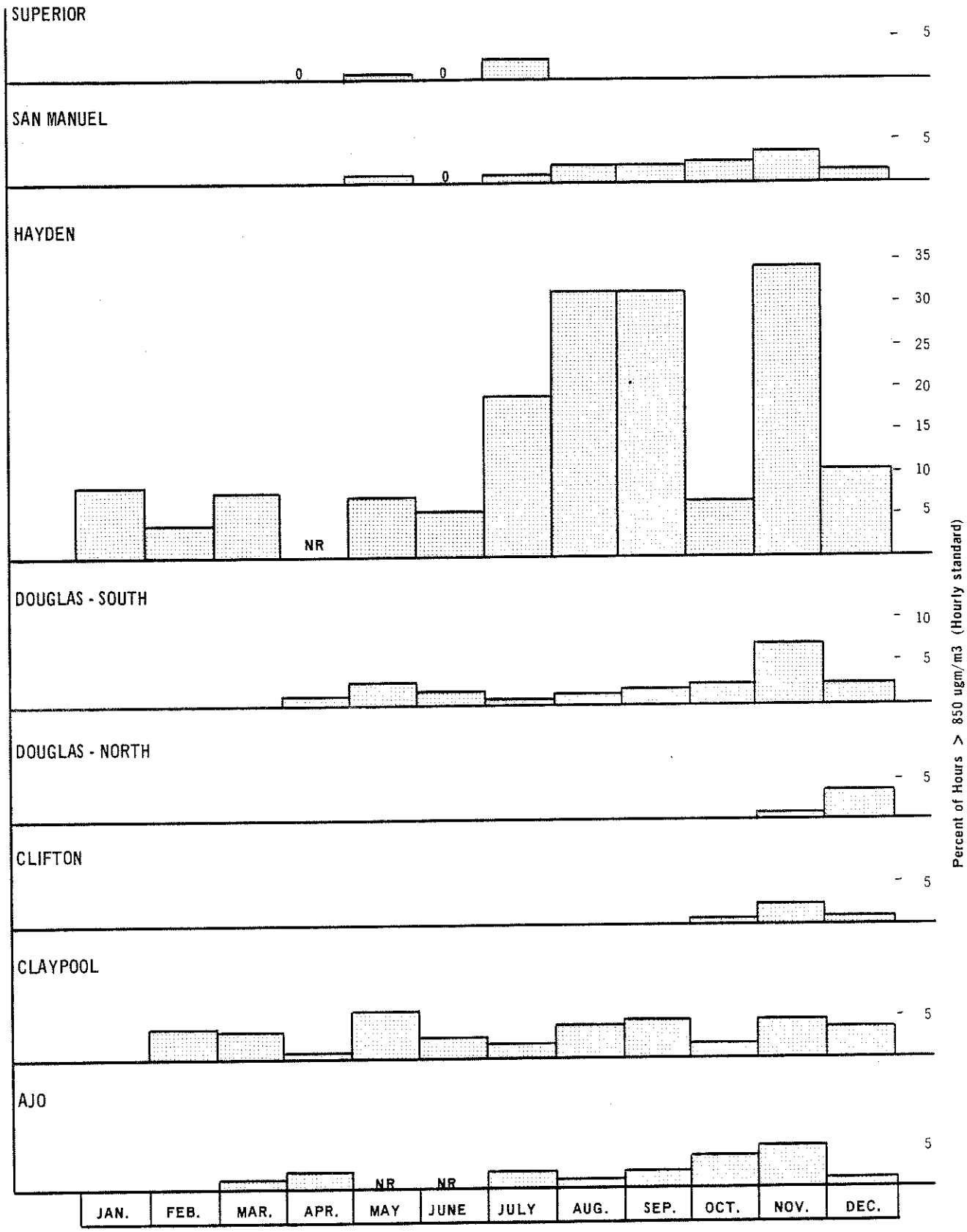
FIGURE C

PERCENT OF HOURLY AVERAGES EXCEEDING HOURLY ARIZONA STATE AIR QUALITY STANDARD (850 ugm/m3) - 1969



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